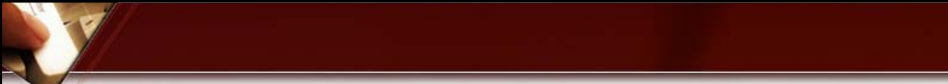




Software Engineering Economics
(CS656)

Business Case Analysis - II

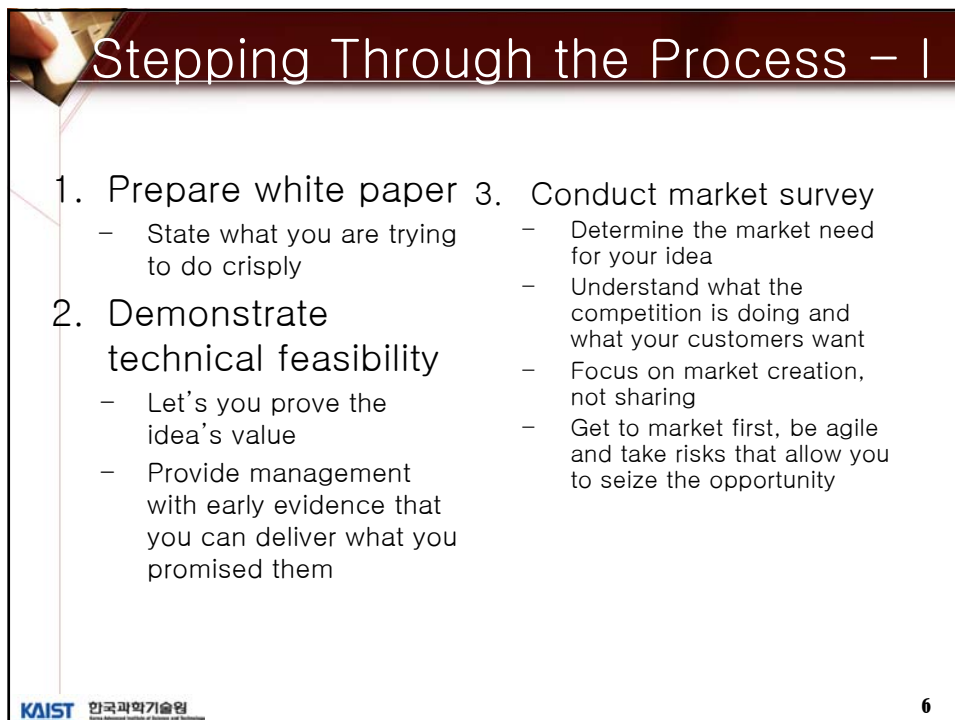
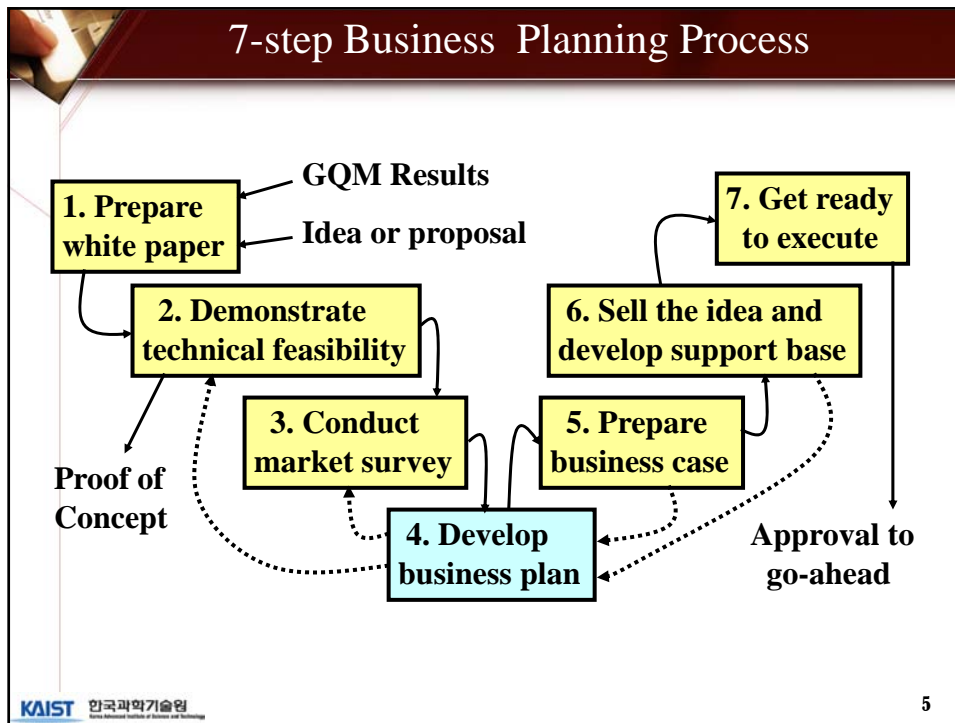
Jongmoon Baik



Making a Business Case



2



Stepping Through the Process – II

4. Develop business plan
 - Needed before idea will be funded
 - Such plans summarize how you will make or save money, not how you'll get the job done
5. Prepare business case
 - Convince sponsor idea makes both good technical and business sense and provides value
6. Sell the idea
 - Package for sales/champion
7. Get ready to execute
 - Plan the project thoroughly (your project plan)
 - Start recruiting key staff
 - Work communications and outreach up front
 - Search out facilities to co-locate team and for conducting demos
 - Prepare your operational concepts (support, etc.)

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Summary

- Business cases are prepared throughout the s/w life cycle to stimulate pursuit of good ideas and improvements
- The GQM can be used effectively to establish a context of business case design
- The business planning process emphasize use of business cases for justification of your initiatives to management
- Software engineers put business cases to work for them as part of the tradeoff analysis throughout the life cycle
- Paying attention to content and packaging is an essential ingredient for business case success

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Making a Business Case

Principles, Rules, & Analysis Tools

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Tooling the Process

The business planning process proceeds in parallel and interfaces with the software development process

Process Framework

Business Planning Process
Tradeoff and Analysis Process
Software Development Process

Analytical Methods	Models	Guidelines for Decision-Making
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“Principles, Rules and Tools for Business Case Development”

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Business Case Principles - I

1. *Decisions are made relative to alternatives*
2. *If possible, money should be used as the common denominator*
3. *Sunk costs are irrelevant*
4. *Investment decisions should recognize the time value of money*


Business Case Principles - II

5. *Separable decisions should be considered separately*
6. *Decisions should consider both quantitative and qualitative factors*
7. *The risks associated with the decision should be quantified if possible*
8. *The timing associated with making decisions is critical*
9. *Decision processes should be periodically assessed and continuously improved*

Use Engineering Economics as its Analytical Basis


$$FW = P(1+i)^N \qquad PV = FW/(1+i)^N$$

Future Worth	Present Value
<ul style="list-style-type: none"> • Takes cost of money into account <ul style="list-style-type: none"> – A \$\$ today is worth more than tomorrow due to inflation • Takes compounding into account 	<ul style="list-style-type: none"> • Normalizes future expenditures using current year dollars as a basis for comparison • Lets you establish a minimum attractive rate of return



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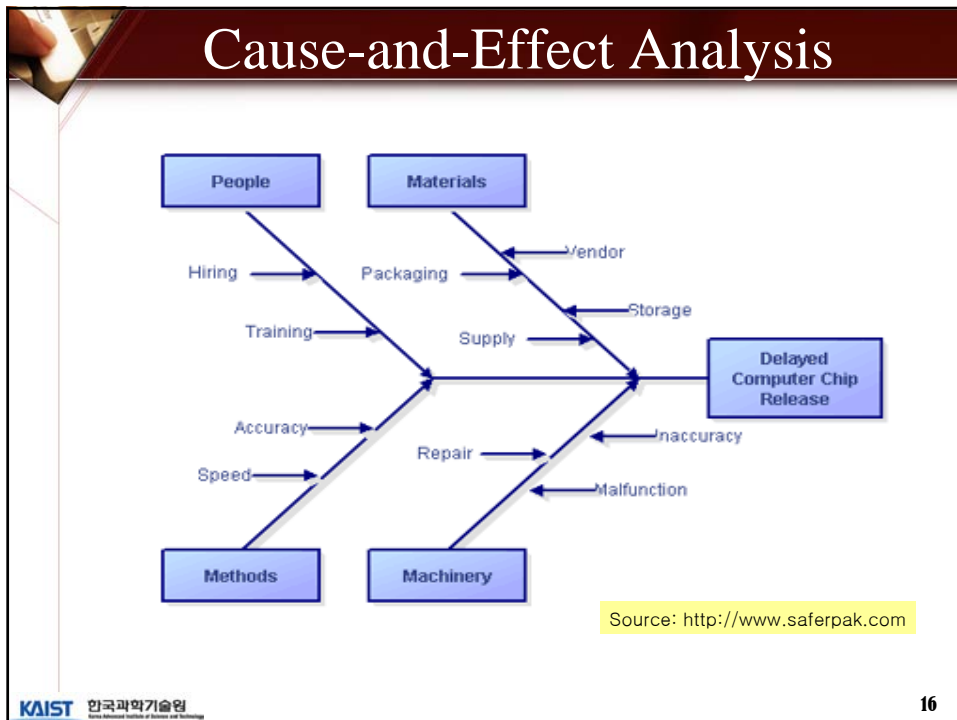
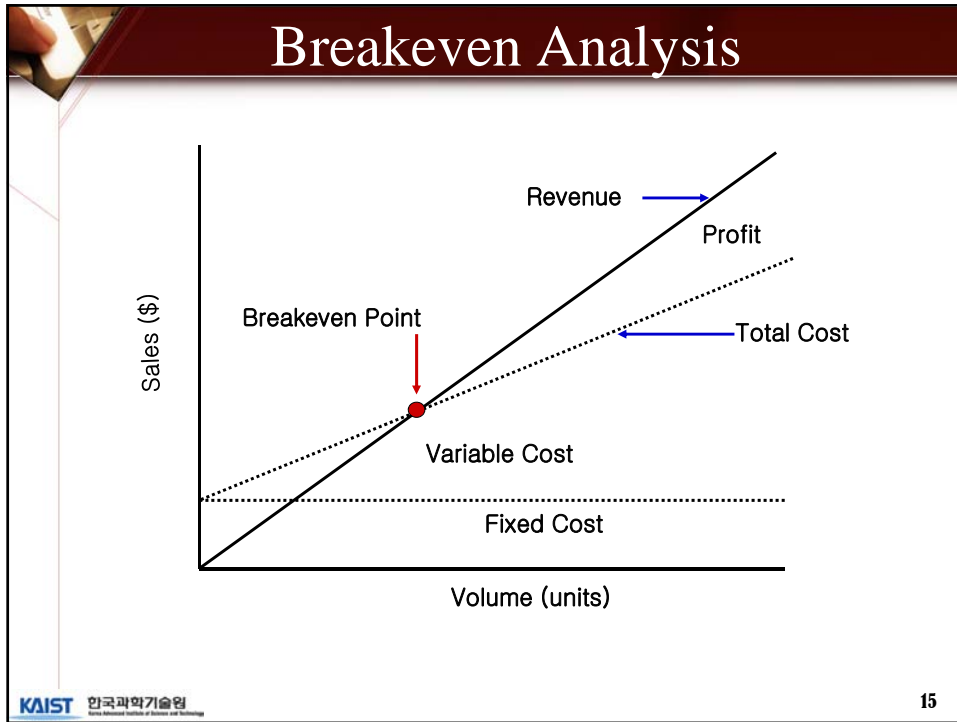
Other Analysis Techniques



- Breakeven Analysis
- Cause-and Effect Analysis
- Cost/Benefit Analysis
- Value Chain Analysis
- Investment Opportunity Analysis
- Pareto Analysis
- Payback Analysis
- Sensitivity Analysis
- Trend Analysis
-


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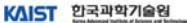
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Doing a Cost/Benefit Analysis

Cost/Benefit Ratio = PV (Total costs (\$) / Total Benefits (\$))

<ul style="list-style-type: none"> • Non-recurring costs <ul style="list-style-type: none"> - Course acquisition _____ - Course conduct _____ - Other _____ <p style="text-align: right;">Total _____</p> • Recurring costs <ul style="list-style-type: none"> - Course maintenance _____ - Continuing education _____ <p style="text-align: right;">Total _____</p> <p style="text-align: right;">Total Costs _____</p> 	<ul style="list-style-type: none"> • Tangible savings <ul style="list-style-type: none"> - Cost avoidance _____ - Cost savings _____ <p style="text-align: right;">Total _____</p> • Intangible savings <ul style="list-style-type: none"> - Reduced turnover _____ - Less risk exposure _____ <p style="text-align: right;">Total _____</p> <p style="text-align: right;">Total Benefits _____</p>
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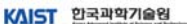

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Value Chain Analysis

The diagram shows a 'VALUE' box on the left with three arrows pointing to 'Option A', 'Option B', and 'Option C'. Each option is represented by a light blue oval. To the right of each option are three stacked rectangular boxes representing High (H), Medium (M), and Low (L) values. Dotted arrows point from the M and L boxes to the Expected Value (EV) calculation.

Option A	H = 40 M = 30 L = 20	EV = 30
Option B	H = 60 M = 20 L = 10	EV = 25
Option C	H = 45 M = 25 L = 15	EV = 26.7

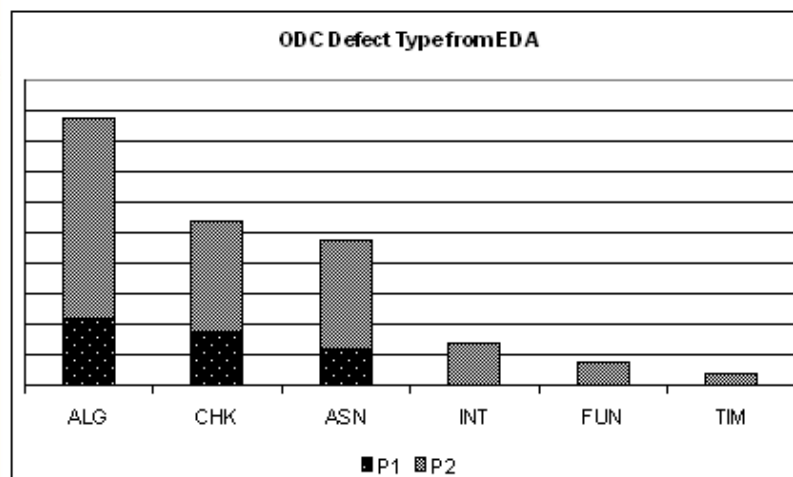
Expected Value_i (EV) = (H_i + 4M_i + L_i) / 6


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Investment Opportunity Analysis

- Return on capital
 - Looks at the amount of money the investment makes over its useful life
 - Computed by dividing the investment's cumulative return by the one-time investment
 - Software Cost : \$50,000 , Cost saving of \$250,000 in labor cost : ROC = 5:1
- After-tax rate of return
 - Used to reduce the projected benefit stream associated with an improvement option by its potential tax liability
 - e.g.: an investment that yielded a 12 % after tax return → an excellent investment if the going interest rate was 5%
- Other financial measures like ROI
 - Can be used to assess the desirability of investment alternatives

Pareto Analysis



Payback Analysis

- Used to determine the number of periods required to recover one's investment: "Payback Period"
- Compare options based on the payback periods

$$\text{payback period} = \text{investment} / \text{net savings}$$
- Disregards the consequences of the investment beyond the end of the payback period
 - Hard to compare options with different useful lives when there is an uneven pattern of cash flows

Sensitivity Analysis

- Sensitivity Analysis
 - “the study of how the variation in the output of a [model](#) (numerical or otherwise) can be apportioned, qualitatively or quantitatively, to different sources of variation”
 - Sensitivity Analysis can be used to determine:
 - The model resemblance with the process under study
 - The [quality](#) of model [definition](#)
 - Factors that mostly contribute to the [output](#) variability
 - The region in the [space](#) of [input](#) factors for which the model [variation](#) is maximum
 - [Optimal](#) - or instability - regions within the space of factors for use in a subsequent [calibration](#) study
 - Interactions between factors

Source: http://en.wikipedia.org/wiki/Sensitivity_analysis

Trend Analysis

“Comparative analysis that looks at movement in the data as a function of time”

- Frequently used for technical purpose
 - e.g.: to pilot cyclomatic complexity as a function of size of a software component
- Displayed graphically so that the tendency of the data are visible

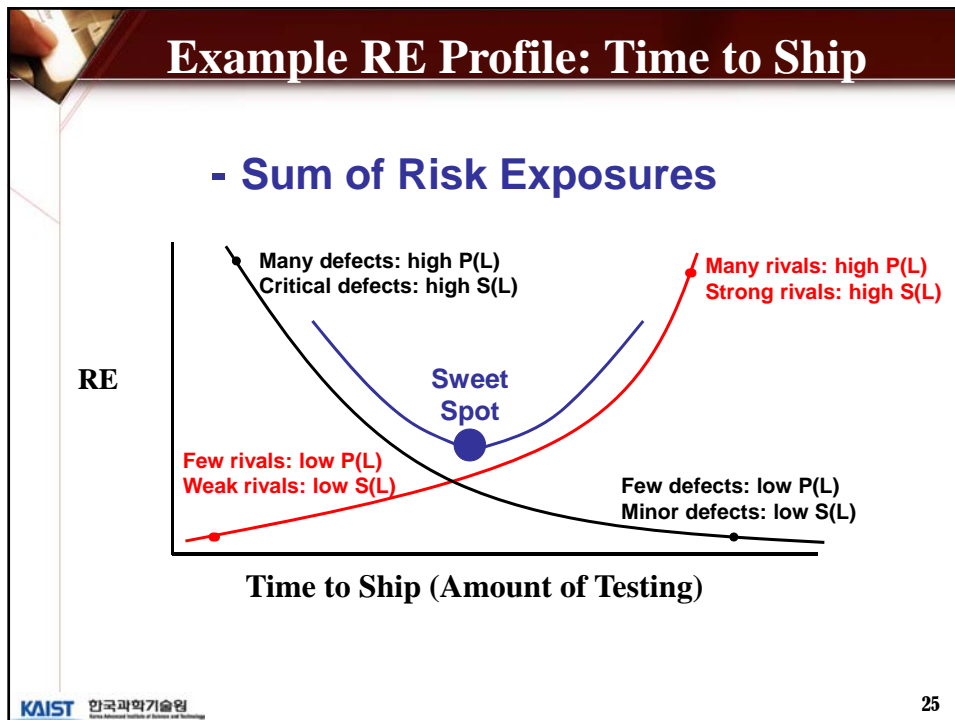
The graph, titled 'Projected Values vs. Goals', plots three metrics against 'Calendar Time'. The left y-axis is 'Percent Defects Found' (0% to 100%), and the right y-axis is 'MTTF & Remaining Unique PRs' (0 to 1000). The x-axis is 'Calendar Time'. Three data series are shown: 'MLE Pot PRs Found' (solid line with circles) increases from 0% to 100%; 'MLE MTTF' (solid line with squares) increases from 0 to 1000; and 'MLE PRs Remaining' (dashed line with diamonds) decreases from 1000 to 0. A vertical dashed line marks 'Goal 95%' at approximately 95% defects found. A vertical solid line marks 'Current' at an earlier time point.

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Quantifying Risk Exposure (RE) via a Profile: Time to Ship

The graph shows 'Risk Exposure (RE)' on the y-axis and 'Time to Ship (Amount of Testing)' on the x-axis. A downward-sloping curve illustrates that as testing increases, risk exposure decreases. Two points on the curve are highlighted: the upper point is labeled 'Many defects: high P(L) Critical defects: high S(L)', and the lower point is labeled 'Few defects: low P(L) Minor defects: low S(L)'.

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Getting Management Approval

- Why should they invest in your improvement instead of other alternatives?
 - There needs to be a compelling business reason, else why make the effort
 - This must be the most attractive option examined
- Why invest now instead of some later time?
 - Need to show opportunity is knocking & funds are available
- What do I have to do if I say “yes” to the proposal?
 - Must show them that their efforts will be minimal; you’ve done all of the leg work and all they have to do is sign

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Tools of the Trade

- Frequently used tools to perform business case analysis
 - Spreadsheets
 - Primary tools used for financial analysis
 - Simple, easy to use, and allow side-by-side alternative comparison
 - Excel, MINITAB, JMP, etc.
 - Cost Models
 - More sophisticated tools
 - Requires time and effort to learn to use
 - COCOMOII, PRICE-S, SEER-SEM, KnowledgePlan, etc
 - Other financial calculators

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Example: COCOMO II

```

    graph TD
      SM[Sizing Model] --> COCOMO((COCOMO II))
      RM[Risk Model] <--> COCOMO
      COCOMO --> BA[* Benchmark analysis]
      COCOMO --> CA[* Comparative analysis]
      COCOMO --> LCCA[* Life cycle cost analysis]
      COCOMO --> PA[* Parametric analysis]
      COCOMO --> TS[* Trade studies]
      COCOMO --> WIF[* "What-if" analysis]
  
```

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Tips to Package Business Cases

- Clearly and Convincingly summarize the business case justification in the executive summary
- Define your terms precisely – Use examples to communicate meaning whenever possible
- Be conservative with your numbers
- Quantify tangible benefits in monetary terms
- Don't mix capital expenditures with project budgets
- Use ranges for cost/benefits whenever possible
- Portray the PV of your benefits in this year's dollars
- Focus attention on the business, not technical issues

Avoiding Taxes & Tax Penalties

- Keep a contingency budget in reserve to fund good ideas and improvements
- Know when surplus funds become available and be first in line to claim them
- Find a sponsor who has cash to fund your idea or improvement
- Initiate efforts in other areas to free up funds for your new idea or improvement initiative.

Q & A



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